Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

Journal of the Society of Arts.

◆

FRIDAY, JANUARY 8, 1869.

Announcements by the Council.

◆

Ordinary Meetings.

Wednesday Evenings at eight o'clock:—

Jan. 20.—"On Photography and the Magic Lantern, applied to the Teaching of History. By Samuel Highley, Esq., F.G.S. Practically illustrated.

Jan. 27.—"On the Progress of the British Colonies." By John Robinson, Esq., of Natal.

Cantor Lectures.

The Second Course of Cantor Lectures for the present Session will be "On Painting," by S. A. Hart, Esq., R.A., late Professor of Painting at the Royal Academy, and will consist of Four Lectures, to be delivered as follows:—

Lecture I.—Monday, February 1st.

On the History of Portrait Painting.

Lecture II.—Monday, February 8th.

On the Practice of Portrait Painting.

Lecture III.—Monday, February 15th.

On the Suggestions offered by surrounding circumstances to the Artist.

Lecture IV.—Monday, February 22nd.

On Landscape Painting.

Each lecture will begin at eight o'clock. These Lectures are open to Members, each of whom has the privilege of introducing two friends to each Lecture. Tickets for this purpose will be forwarded in due course.

FINAL EXAMINATIONS, 1869.

Notice to Institutions and Local Boards.

In order to avoid holding these Examinations on the same evenings as those of the Department of Science and Art, it has been decided to hold them, in 1869, on the evenings of

TUESDAY, the 20th APRIL,
WEDNESDAY, the 21st ,,
THURSDAY, the 22nd ,,
FRIDAY, the 23rd ,,

From 7 p.m. to 10 p.m., instead of on the 27th, 28th, 29th, and 30th April, as announced in the Programme of Examinations for 1869.

In consequence of this alteration the Previous Examinations must be held earlier, and the Forms No. 2 and No. 4, referred to in par. 6 of the Programme, must of course be sent in a week earlier than the dates there fixed for receiving them.

It is very important that this alteration should be made as public as possible. For this purpose a number of small slips, to be inserted between pages 8 and 9 of every Programme sent out, have been forwarded to each Institution and Local Board. They should also be specially sent to any person to whom Programmes may have already been forwarded.

Large bills, to be suspended on the walls of the Institution reading-room, or in some other public place, will also be provided.

Subscriptions.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

◆

Cantor Lectures.

"On the Aniline or Coal Tar Colours."

By W. H. Perkin, Esq., F.R.S.

Lecture II.—Delivered Monday, December 14th.

Mauve, Magenta, and some of their Derivatives.

You will remember that in my last lecture we went over all the various steps between coal and colour. We saw how coal tar was produced from coal; how coal tar, naphtha, and benzol were separated from coal tar; how nitrobenzol and aniline were made from benzol, and concluded with an account of the preparation of aniline purple, or mauve from aniline. We will now proceed to the study of some of the most remarkable properties of aniline purple.

This colouring matter is sometimes supplied to consumers in a pure and beautifully crystalline condition. This product is found to be a salt of a compound, chemically termed an organic base. This base has been called "mauveine;" it is composed exclusively of carbon, hydrogen, and nitrogen, in the following proportions:—

$$C_{27}H_{24}N_4$$

Mauveine, although the base of aniline purple, when in solution is not of a purple but of a dull violet shade, and in the solid state is a nearly black crystalline powder. The moment, however, mauveine is brought in contact with an acid so as to form a salt, its solution changes to a purple colour. This takes place even with that feeble acid carbonic. I have here a dilute solution of mauveine; you will observe the dull violet colour it possesses, but if my assistant only breathes through it a few moments the carbonic acid of his breath will combine with it, and it will acquire the ordinary colour of aniline purple.

Mauveine is a most powerful chemical body, and will easily decompose ammoniacal salts. This may be readily seen if some mauveine be heated with chloride of ammonium and a little water, when an abundance of ammonia gas will be evolved, which can be distinguished not only by its odour, but by the white fumes it produces with hydrochloric acid.

The salts of mauveine are beautifully crystalline, and possess a splendid green metallic lustre. The crystallised commercial product consists of the acetate. Mauveine possesses one of the peculiar properties of indigo. Indigo, when treated with reducing agents, such as a mixture of sulphate of iron and lime, is rendered nearly colourless and soluble, but this colourless indigo, when subjected to the oxidising influence of the atmosphere, rapidly becomes blue again. I here refer to the indigo vat so much used by dyers. Mauveine, when treated in a similar manner, is also nearly decolourised, changing to a pale brownish yellow fluid, but the moment this is exposed to the air it assumes its original colour far more quickly than indigo. This remarkable fact may be strikingly illustrated by boiling an alcoholic solution of salt of mauveine with a few strips of zinc in a sealed tube from which the air has been previously removed. The dark purple solution will gradually lose its colour, and change to a very pale-yellowish brown shade.

I have a tube containing some aniline purple decolourised in this manner, and now if I open it, the air rushes in and the solution instantly assumes the ordinary purple colour.

Ordinary indigo is quite insoluble in water, and, therefore, its property of becoming soluble, as well as colourless, when treated with reducing agents, is of great practical value, as the dyer, by immersing his goods in this solution of indigo, and then exposing them to the oxidising influence of the air, gets the colouring matter firmly fixed in the fibre of his materials. But as the mauve is always soluble in water, this property has not been found of any practical value.

Aniline purple, when introduced as a dye, being the first colour of its kind, had to encounter many prejudices, and, on account of its peculiar nature, required the adoption of new or modified processes for its application. These difficulties, however, once overcome, its progress was very rapid. At first it was principally employed by the silk dyer and printer, its application to silk being comparatively easy, but it was not used by the calico-printer till a few years afterwards.

I distinctly remember, the first time I induced a calico-printer to make trials of this colour, that the only report I obtained was that it was too dear, and it was not until nearly two years afterwards, when French printers put aniline purple into their patterns, that it began to interest British printers.

It will be seen that to introduce a new coal-tar colour after the mauve was a comparatively simple matter. The difficulty in the manufacture of all the raw materials had been overcome, as well as the obstacles in the way of the practical applications of an aniline colour to the arts.

We will now turn our attention to a colouring matter which has often been confounded with aniline purple. I have designated it as "Runge's blue," as it was first observed by Runge. I have mentioned that Runge, when he first obtained aniline, termed it "kyanol," or blue oil, on account of the blue-coloured solution it gave with chloride of lime.

After discovering the mauve, I naturally made experiments with this coloured product of Runge's, to see if it contained aniline purple, but my experiments answered the inquiry in the negative. A few years afterwards, however, I was puzzled by finding that French manufacturers were beginning to produce aniline purple by the agency of chloride of lime and a salt of aniline; being much occupied at that time, I was unable to look carefully into the matter; and it was not until investigating these apparently opposite results a short time since that I was able to understand them. I will perform Runge's experiments, and for that purpose will take a solution of hydrochlorate of aniline, and add to it a very dilute solution of chloride of lime (taking care not to add too much). The solution is now changing, and getting slightly opaque; by daylight it has an appearance like indigo, but if I render it clear by the addition of alcohol, and place it before the magnesium lamp, it is seen to be of a brilliant colour, and nearly pure blue, quite unlike aniline purple.

I have lately succeeded in obtaining this blue product in the solid condition, by treating a solution of hydrochlorate of aniline with a dilute solution of chloride of lime, and precipitating the resulting colouring matter with common salt; it is thus obtained in an impure condition, and may be collected upon a filter; by treatment with cold ether or benzol, a large quantity of brown impurities are separated, the colouring matter being left in the solid condition. This substance dissolves in alcohol, forming a nearly pure blue solution, and is capable of dyeing silk a blue or blue-violet colour.

An alcoholic solution of Runge's blue behaves with caustic potash quite differently to aniline purple, forming a brownish red-coloured solution instead of a violet. Therefore, there can no longer be any reason for confounding this body with aniline purple, it being entirely different, both in colour and chemical properties. But as this colouring matter is produced by oxidising hydrochlorate of aniline with chloride of lime, how is it that manufacturers have succeeded in preparing aniline purple with the same re-agents? This question I find is very easy to answer; the manufacturer has gone a step further and boiled his product. Now, if I take a piece of silk dyed with Runge's blue, and, instead of boiling it, which would wet it, and make it difficult to manipulate, do that which is equivalent—steam it—a very remarkable change takes place—Runge's blue being changed into the mauve. So, here we have cleared up the mystery, and find that by the action of chloride of lime on hydrochlorate of aniline, we first get Runge's blue, and then, by heating this blue, we change it into mauve. Runge's blue is a very unstable body, and of no practical value, its alcoholic solution changing into mauve in a day or two. This change takes place directly by boiling.

We must now pass on to another colouring matter, in name well-known to all of you, I mean magenta, also called roseine, fuchsine, aniline red, and various other names. The discovery of this body and its manufacture were strangely dependent upon the source which had been selected for the preparation of aniline for the mauve. Had the aniline contained in coal tar, or the aniline obtained from indigo, been employed for the preparation of the mauve, instead of that prepared from commercial benzol, magenta and its train of coloured derivatives would in all probability have remained unknown to this present day, from the simple fact that magenta cannot be produced from pure aniline, a second body being also required.

You will observe, by reference to the table of coal tar products, that next to benzol there is a substance named toluol, a substance having a boiling point not very much above that of benzol. On this account toluol is always contained in commercial benzol, and possesses most of its properties. With nitric acid it forms nitrotoluol, very similar to nitrobenzol; with iron and acetic acid it is converted into a base, toluidine, very similar to aniline, except that it is solid instead of liquid. when pure. Therefore, aniline prepared from commercial benzol always contains a little toluidine, and this is the second body requisite for the formation of magenta.

An apparatus for the fractional distillation of coal tar naphtha has been devised, so that its constituents may be almost completely separated from each other, and thus pure benzol or pure toluol may be obtained.* Having obtained these hydrocarbons, pure aniline and pure toluidine may be prepared and then mixed in the most suitable proportions for manufacturing magenta. This process is not very generally employed, however, but the quality of the mixture of aniline and toluidine is determined by distillation, noting the quantities which come over at different temperatures. The necessity of toluidine as well as aniline for the production of magenta was discovered by Dr. Hofmann, who found that it could not be produced by perfectly pure aniline, nor perfectly pure toluidine, but that a mixture of these two bases yielded it in quantity. Magenta was apparently first observed by Natanson, in 1856, when examining the action of chloride of ethylene on aniline, and afterwards by Dr. Hofmann, in 1858, when studying the action of tetrachloride of carbon on aniline, but industrially the discovery of magenta was made by M. Virguin, of Lyons, in 1859, three years after the mauve. M. Virguin's process consisted in treating commercial aniline with a fuming liquid, called tetrachloride of tin, and was first carried out by Messrs. Renard Brothers, of Lyons. Since 1859 patents have been taken out for the production of this colouring matter with aniline, and almost all chemicals known, whether capable or incapable of forming magenta. I may mention one process which was extensively employed, and is still used to some extent in Germany, and that is the method of making magenta with commercial aniline and nitrate of mercury. With care this process works very well, and the colouring matter produced is of good quality. When first introduced, magenta prepared by this method was not purified, but sent into the market in a crude form, so that before using it the dyer had to extract it with water. In the preparation of magenta by this process, all the mercury of the nitrate of mercury employed is recovered in the metallic state, but although this process may possess some advantages, yet the use of mercury salts is most undesirable, on account of their fearfully deleterious influence upon the workmen.

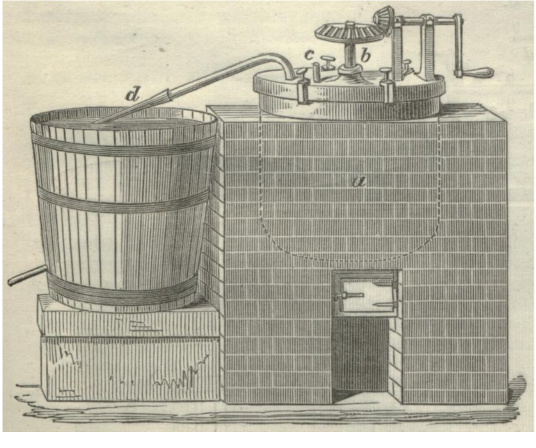
---

* See "Clarke's Specification," A.D. 1863, June 5th, No. 1,405.

The process, which has almost superseded all others, is that for the use of arsenic acid, as proposed by Medlock, and patented by him in January, 1860. This patent is notorious for the amount of litigation it has caused, showing that a patentee should not only be a discoverer but a lawyer, and even more, and able to discover precisely how much to claim and disclaim in his patent, and also to arrange his specification so that the intellects of the whole world may not be able to discover a single flaw in his description; and it is a common misfortune to inventors who wish to thoroughly protect themselves, to find that they have claimed too much.

The manufacture of magenta, as now carried on, is a very simple process; it is conducted in an apparatus somewhat similar to that represented by fig. 5.

Fig. 5.



This apparatus consists of a large iron pot, *a*, about 4ft. diameter, set in a furnace of brick-work; it is provided with a stirrer, *b*, worked by hand. All the gearing for this stirrer is fixed to the lid, so that stirrer, lid, and all may be lifted away by means of a crane, or other suitable apparatus. There is also a bent tube fixed into the lid, and connected to a condensing worm, *d*, by means of a joint, which can be made or broken at pleasure. In preparing magenta, a quantity of aniline, containing about 25 per cent. of toluidine, and a nearly-saturated solution of arsenic acid, is introduced into this apparatus, and well mixed by working the stirrer; the proportions of the materials are in about the ratio of 1 of aniline to 1·5 of a 75 per cent. solution of arsenic acid. When these are well mixed the fire is lighted. After the product has been heated for some time water begins to distil over, then aniline and water, and lastly nearly pure aniline.

This operation requires some hours for completion, and this is determined by inserting an iron rod, from time to time, and drawing out a portion of the product for examination, as well as by the amount of aniline which distils over. When the heating has been completed, a steam-pipe is introduced into the apparatus, and steam blown through the fused mass; by this means an additional quantity of aniline is separated. The lid is then liberated and lifted, with the stirrer, from the apparatus, and the product left to cool before it is removed. A more elaborate and larger apparatus is sometimes used, which possesses considerable advantages over the smaller one. The iron pot is larger, and is provided with an outlet at the side, which is closed during the operation, and the shaft of the stirrer is hollow (as in the aniline apparatus described last lecture, fig. 4), and worked by steam. When the operation of heating is concluded, steam is blown down the shaft, and after the addition of water the product is boiled and run out of the outlet in the side of the pot; by this arrangement it is unnecessary to disconnect the lid of the apparatus, and the product does not require to be removed by mechanical means, as with the apparatus previously described.

The crude product obtained by heating aniline and arsenic acid, is next transferred to vats, boiled with water and filtered. Common salt is then added, which precipitates the crude magenta; this is collected and dissolved in boiling water, again filtered, and the solution, on cooling, deposits the colouring matter in the crystalline condition. This, when recrystallised, constitutes commercial magenta.

Commercial magenta consists of brilliant crystals, sometimes half-an-inch in length, having a beautiful golden green metallic appearance; these dissolve in warm water almost entirely, forming an intense purplish red solution. Dr. Hofmann has carefully studied the chemical nature of magenta, and has found it to consist of the salt of an organic base, which he has called rosaniline. This base may be obtained from the commercial product, by dissolving it in water and boiling it with an alkali, or alkaline earth, such as ammonia, potash, or lime; it is thus rendered nearly colourless, and after filtration rosaniline separates from the clear solution, on cooling, in colourless crystals. It is composed of carbon, hydrogen, and nitrogen when anhydrous, but generally contains an equivalent of water also. The anhydrous base has the formula—

$$C_{20}H_{19}N_3$$

This colourless base immediately becomes dark red upon combining with an acid, as I can show you by heating some with acetic acid, when the colour is immediately developed. The magenta produced by heating commercial aniline with nitrate of mercury is the nitrate of rosaniline; that produced with arsenic acid is the arseniate, but in the process of purification this latter salt becomes converted into hydrochlorate, which is the salt most generally found in the market. Other salts are also commercially manufactured, such as the oxalate and acetate, especially when a very pure product is required; these salts are generally prepared from pure rosaniline, by combining it with the required acid, and crystallising from water.

The acetate of rosaniline crystallises in magnificent octahedra, possessing the ordinary golden green metallic lustre to a very high degree; it is also the most soluble salt of rosaniline known. The affinity of rosaniline salts for animal fibres is very great; it does not, however, resist the action of light nearly to the same extent as the mauve. All the derivatives of rosaniline also possess a very great affinity for animal fibres, in most cases quite equal to that of magenta itself.

When speaking of aniline purple, I showed you that by reducing agents it became colourless, or nearly so, but that the original colour was developed when it was exposed to the oxygen of the air. Salts of rosaniline or magenta are also decolourised by reducing agents, but, unlike aniline purple, the colour is not restored by exposure to the air. Dr. Hofmann has found that in this case a new organic base is produced which he has called leucaniline. This substance differs only from rosaniline in containing an additional quantity of hydrogen. It may be reconverted into rosaniline by oxidising agents such as bichromate of potassium, &c.

There is another very peculiar reaction of rosaniline. This base, when brought in contact with hydrocyanic acid, instead of forming a coloured hydrocyanate of rosaniline, yields a perfectly colourless body, which is not a salt but a base. This remarkable fact was discovered by Dr. Hugo Müller, and he has called this new body hydrocyanrosiline. We shall have occasion to refer again to this substance and leucaniline.

In the formation of magenta, a second product is obtained, commercially called phosphine. This substance was first introduced by Mr. E. Nicholson. Dr. Hofmann has investigated it, and found it also to contain an organic base, which he has called chrysaniline.

Phosphine or chrysaniline is not capable of being produced at will, and the quantity formed in the manufacture of magenta is variable. In shade it is of rather a yellow orange. This colouring matter differs from rosaniline, the base of magenta, in exactly the opposite direction to leucaniline, containing two atoms less of hydrogen. Leucaniline, rosaniline, and chrysaniline, are thus related:—

Leucaniline	$C_{20}H_{21}N_3$
Rosaniline	$C_{20}H_{19}N_3$
Chrysaniline	$C_{20}H_{17}N_3$

The principal use of phosphine is for the formation of a scarlet with magenta. It is not converted into magenta, nor decolourized with reducing agents or hydrocyanic acid, and therefore does not seem to be of the same class of colouring matters as rosaniline.

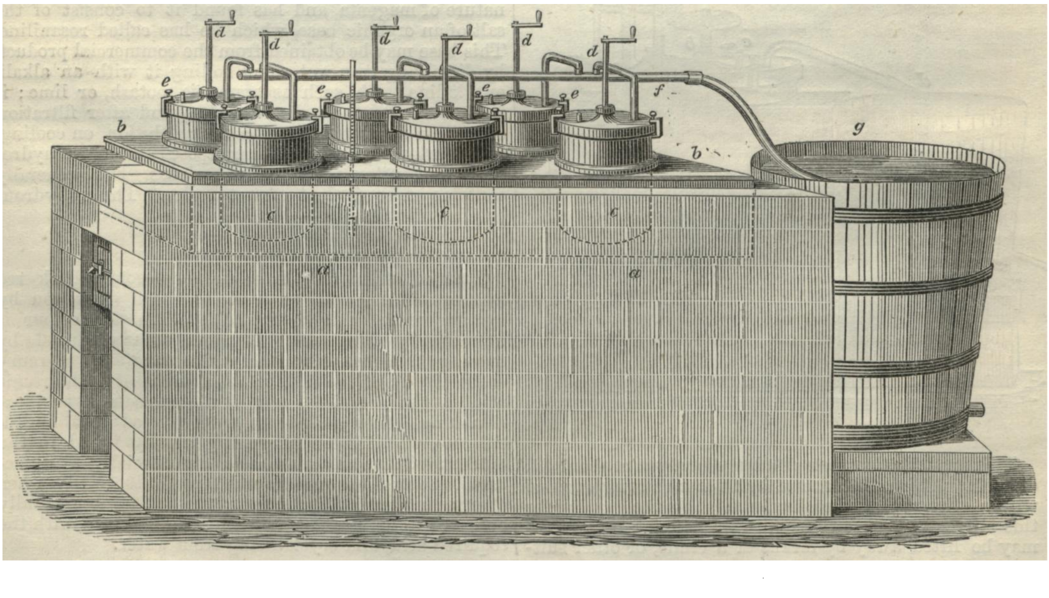
From the residues obtained in the manufacture of magenta three new colours have been obtained by Messrs. Girard and Delaire, but, I am sorry to say, my time will not allow me to enter into the particulars of these products. I believe they have not been commercially introduced as yet.

Magenta is now more used as a source of other colours than as a dye. This has caused its manufacture to be conducted on a very extensive scale, and it is now looked upon by the manufacturer as a raw material much in the same way as aniline was regarded in the early days of aniline purple.

We will next consider some of the derivatives of magenta, and the first we will study is aniline blue or bleu de Lyon. If aniline be treated with a salt of rosaniline or magenta, a remarkable change takes place; at first the colour gradually becomes purple, but afterwards gets quite blue, ammonia being evolved at the same time. This peculiar reaction was observed by MM. Girard and Delaire, who found that this change of colour was due to the formation of a new body, which they termed the bleu de Lyon; intermediate products were likewise obtained, to which we shall refer presently. MM. Girard and Delaire patented their process in January, 1861. This new aniline blue is one of the most important of the artificial colouring matters, and its manufacture has been very much improved upon since its discovery. There are several circumstances which materially influence the beauty of its tint, such as the quality of the aniline and the particular salt of rosaniline employed in its manufacture. It is found by experience that the aniline should be as pure and free from toluidine as possible, and that the salt of rosaniline should contain a feeble acid, such as the acetate, valerate, oleate, or benzoate; but why the latter is necessary chemists are unable to understand at present. Practically, the various salts of rosaniline required for the manufacture of the blue are not prepared separately, but are produced in the operation by double decomposition, which is simply a process of exchange; thus, if acetate of rosaniline is required, a mixture of hydrochlorate of rosaniline and acetate of sodium is employed; these re-act on each other, and change into acetate of rosaniline and chloride of sodium.

On the large scale, the process of making aniline blue is carried out in various ways, but many employ the apparatus shown in fig. 6. This apparatus con-

Fig. 6.



sists of an oil bath, *a*, set in a brick furnace; it has a cover, *b*, perforated with large holes; into these holes are placed small enamelled cast-iron pots, *c*, provided with a flange, on which they rest. These pots will hold from three to five gallons, and are fitted with lids held down with clamps; each lid is provided with a small stuffing-box, through which the rod of a stirrer, *d*, passes. In the lid are also two other perforations; one of these is fitted with a wooden plug, *e*, for the purpose of testing the progress of the operation; the other is connected with a bent, movable tube, *f*, united to a long central main, to collect any aniline vapour which passes over. This main is connected at one end with a worm, *g*, to condense the vapours. The oil bath by which these pots are heated is provided with a thermometer, so that the temperature may be properly regulated. In preparing the blue a mixture of magenta, acetate of sodium and aniline is introduced into the pots, the aniline being employed in excess. When charged the oil bath is heated up to 190°C., and kept near that temperature. At first the red colour of the mixture changes slowly, but afterwards with rapidity. The progress of the operation is ascertained by removing the wooden plug, and withdrawing a small quantity of the product upon the end of an iron or glass rod, and it is considered complete when a good blue colour has been obtained; to ascertain this point with precision, considerable experience is necessary. The excess of aniline distils during this operation, and is condensed by the worm, and collected in a suitable receiver, so that it may be used again.

From the crude blue product thus obtained, which is a fluid of the consistency of treacle, all the different qualities of blues found in the market are prepared. The cheaper qualities are obtained by simply treating the crude product several times with hydrochloric acid. This removes all the free aniline, and most of the red and purple impurities. Another similar but more effective process is employed for the preparation of the better qualities, and consists in mixing the crude product with methylated spirits of wine, and pouring it into water acidulated with hydrochloric acid, and then thoroughly washing the colouring matter which it precipitates with water. But for the purest kinds of blue there are several processes employed; these are based upon the difficult solubility of some of its compounds in alcohol. In preparing these very pure qualities of blue, instead of starting with the crude product, one of the purified blues is taken.

Aniline blue, or "bleu de Lyon," is supplied to consumers as a coarse powder having a coppery lustre, or in alcoholic solutions; it is nearly insoluble in water, and has to be dissolved in alcohol before it is added to the dye bath.

The nature of this blue has been determined by Dr. Hofmann. It is found to contain, like magenta, a colourless base, becoming blue only upon combining with acids. Dr. Hofmann has shown this base to contain—

$$C_{38}H_{31}N_3$$

and has called it "triphenylrosaniline." Like rosaniline, it becomes colourless when treated with nascent hydrogen, forming a new base, giving colourless salts, as leucaniline. The composition is—

$$C_{38}H_{33}N_3$$

The insolubility of aniline blue in water has been found a great drawback to its use, because when employed for dyeing it is thrown out of solution in the dye bath, and then mechanically adheres to the goods, so that it afterwards rubs off.

Mr. Nicholson has, however, discovered a process for rendering this blue perfectly soluble in water. His process closely corresponds to that employed to render indigo permanently soluble. This, it will be remembered, is effected by subjecting indigo to the action of concentrated sulphuric acid, whereby a sulpho acid is produced.

Mr. Nicholson has found that aniline blue, when treated by a similar process, also forms a sulpho acid, perfectly soluble in water, and forming with alkalies nearly colourless solutions. These, however, when decomposed by acids, change back to the original blue.

This soluble blue is now much used for silk dyeing, but by dyers it is not thought to be so fast as the normal compound. By some modification of the process just described, Mr. Nicholson has obtained another soluble blue, commercially known as "Nicholson's blue." This is now very extensively employed in Great Britain for wool dyeing, but its application does not appear to be well understood in France and Germany, so that its use there is not so great as in our own country.

If a salt of rosaniline and aniline be heated together, and the process stopped before aniline blue is produced, the resulting product when treated with dilute acid gives a colouring matter, which has been called "violet imperial." This was at first supposed to consist of a mixture of blue and magenta, but recent research has shown it to consist of intermediate products. Very large quantities of this colouring matter have been used, but its consumption is now rapidly falling off, owing to the introduction of new violets, about to be described. A few months after the discovery of aniline blue, another colouring matter, called the "bleu de Paris," was obtained by M. M. Persoz De Luynes and Salvetat. These chemists found that when aniline was heated with tetrachloride of tin for thirty hours to 180°C. in a sealed tube, neither a red nor a violet, but a very pure blue was produced. This colouring matter is generally described as being identical, or probably identical, with the bleu de Lyon. These blues are, however, widely different in their chemical nature, as the bleu de Paris is easily soluble in water, and crystallizes freely in needles of a blue colour, with a coppery reflection. It consists of the hydrochlorate of an organic base, which is precipitated from its solution by alkalies as a purplish blue powder; it dyes silk readily, and retains its blue colour by artificial light. It is remarkable that the discoverers of the bleu de Paris do not seem to have observed its difference from the bleu de Lyon.

I have prepared some of this product with a view to its examination, but hitherto have been prevented from determining its composition. I hope to do so soon.

The bleu de Paris is, unfortunately, difficult to prepare in large quantities, and has never been introduced commercially.

The recognition of the nature of the bleu de Lyon, by Dr. Hofmann, led him to study the action of a class of substances upon rosaniline, known to chemists as the iodides of the organic radicals; this investigation resulted in the discovery of the brilliant colours known as the Hofmann violets, and of which so many shades can be obtained, from a very red purple to a nearly pure blue.

The substances generally used for the preparation of the Hofmann violets from rosaniline are the iodides of methyl and ethyl; the iodide of methyl differs from that of ethyl in a practical point of view, in being rather quicker in its action; it is also more volatile. Both these substances contain a remarkable element called iodine. This body is found in sea-water and sea-weed; its aspect is very similar to that of a metal; one of its characteristic properties is that when heated it volatilizes and produces a beautiful purple coloured vapour, and here we find how dangerous a little knowledge is when relied upon. When the iodide of ethyl, which, as I have told you, contains iodine, was introduced for the preparation of the Hofmann violets, it was stated in some of our periodicals or daily papers, I do not remember which, that chemists had at last succeeded in fixing the colour of iodine, whereas, the iodine has nothing whatever to do with the colours produced with the iodides of ethyl and methyl, but is simply an instrument in bringing about the change which takes place in their formation; moreover, these colours can be equally produced without using iodine at all. It is unfortunate that the popular reports upon scientific matters are generally so utterly untrustworthy. One of the most remarkable reactions of iodine is the blue violet colour it gives with a solution of starch; this is used as a test for its presence when in the free condition, and is remarkably delicate; it is of no use as a colour, as it is instantly decomposed when heated. To prepare iodide of ethyl, ordinary alcohol is treated with iodine and phosphorus; the operation has to be conducted with care, as iodine reacts upon phosphorus with great energy; usually the alcohol and phosphorus are placed in a retort, and the iodine added very carefully, and in small quantities at the time. The mixture is then distilled, and the distillate mixed with water, which causes the iodide of ethyl to separate as a colourless heavy oil. Iodide of ethyl is very volatile, boiling at 70°C.; it has an ethereal odour, and when pure is colourless and transparent; it contains no less than 81 per cent. of iodine. Iodide of methyl is prepared in exactly the same manner as that of ethyl, substituting wood naphtha, or methylic alcohol, for ordinary alcohol; it contains a still larger quantity of iodine than the iodide of ethyl, viz., 89 per cent.

For the preparation of these substances on the large scale special apparatus has been devised, and sometimes amorphous or red phosphorus is substituted for the ordinary kind; but I shall not have time to enter more fully into this subject. To produce the violets, Dr. Hofmann heats pure rosaniline with iodide of ethyl, or methyl and methylated spirits of wine, in a cast-iron digester, closed air-tight, with a lid fastened down with screws. A process very similar to this is sometimes employed, and consists in using a salt of rosaniline, caustic alkali, iodide of ethyl, and alcohol. But in Germany the ordinary hydrochlorate of rosaniline is employed with alcohol, or wood spirit and iodide of ethyl, and is found to work very successfully. By employing the rosaniline itself a lower temperature is required for the formation of violet, than when using its salts; in fact, I have found that a mixture of iodide of ethyl and rosaniline re-act even at the ordinary temperature if left in contact for a few days, and produce a red shade of violet.

On the large scale Hofmann's violet is generally prepared in deep cast-iron vessels, surrounded with a steam jacket, and provided with a lid having a perforation, closed with a screw plug. This lid can be firmly fastened down with screws, the joint being made with a vulcanised indiarubber washer. This apparatus is charged with a mixture of hydrochlorate of rosaniline dissolved in alcohol or wood spirit, and iodide of ethyl or methyl, in proportion according to the shade required. After the apparatus is closed the steam is allowed to enter the steam jacket, and the heating continued for five or six hours; the plug is then removed from the lid of the apparatus, and the alcohol or unused iodide of ethyl distilled off. The resulting product is dissolved in water, filtered, and precipitated with chloride of sodium, but sometimes it is first treated with caustic alkali, to remove all the iodine, so that it may be recovered. Thus obtained, the colouring matter is of a golden lustre if of a blue shade, and of a greenish if of a red shade.

Like all the other colours we have considered, the Hofmann violets are nearly white organic bases, their composition differing according to the shade of colour, thus:—

A red shade is composed of ..	$C_{22}H_{23}N_3$
A red violet shade, of	$C_{24}H_{27}N_3$
A very blue shade	$C_{26}H_{31}N_3$

The colours of the Hofmann violets are remarkable for their brilliancy, but, unfortunately, they do not resist the action of light so well as might be desired; it is remarkable, however, that the regard for fastness seems to have given way to the desire for brilliancy.

In the early days of coal-tar colours fastness was so much talked about, that when magenta was first introduced it was thought by some that it would not be largely used—how different has it proved to be. Although not very fast upon cotton, the Hofmann violets are sufficiently so for woollen and silk goods, as colours always resist the light better when applied to animal fibres.

In the formation of Hofmann violets we see that rosaniline, when treated with iodide of ethyl, becomes blue, the red being converted into violet; but with mauveine, the base of the mauve, exactly the reverse takes place, the mauveine being converted into a much redder shade with iodide of ethyl. The colouring matter produced from mauveine and iodide of ethyl is commercially known as "dahlia;" the colour is intermediate in shade between aniline purple and magenta. This colouring matter possesses the same character for fastness as the mauve, and also gives the same reactions with acids; unfortunately it is rather expensive, and has therefore not been very extensively used.

Lastly, there has been a process proposed for the production of colouring-matters similar to the Hofmann violets, by first converting the aniline into ethyl-aniline, a base previously discovered by Dr. Hofmann. It is found that by substituting this base for aniline, in some of the processes which have been employed for the manufacture of magenta, the ethyl-aniline yields purple or violet colouring-matters.

This process has been patented by M.M. Poirier and Chappat, but the reaction appears to have been first observed by M. E. Kopp. From the great similarity of these colouring matters to the Hofmann violets, I need not enter into any lengthened description of their properties.

Sea-water contains, besides iodine, another remarkable element called bromine; it is a liquid giving off very irritating orange-coloured vapours. This remarkable body yields, with many hydro-carbons, a great variety of compounds. With ordinary turpentine, it acts with great violence; but if the action be moderated by the presence of a large quantity of water, a thick viscid oil is obtained. This body was examined by Mr. C. Greville Williams, who found it to possess the formula—

$$C_{10}H_{15}Br._3$$

I have found that this substance, when heated with a solution of magenta in methylated spirits, produces a purple colouring matter of great beauty, commonly known as the Britannia violet; it is very extensively employed for dyeing and printing, and can be produced of any shade, from purple to a blue violet.

The Britannia violet possesses the golden green lustre so common to all the aniline colours. It is easily fusible, amorphous, and very soluble in water.

In my last lecture I showed you the great intensity of the mauve dye. I will now make a few experiments, to illustrate the great intensity of some of the colouring matters we have been considering this evening.

I have here some screens of white paper, on which I have dusted a very small quantity of the solid colouring matters,—so small a quantity that I dare say you can scarcely discover its presence. If I now project spirits of wine upon these screens, so as to dissolve the colours, you will see their remarkable intensity.

Let us now consider for a moment the great rapidity with which the discovery of new coal-tar colours followed that of the mauve or aniline purple.

Aniline purple was discovered in 1856; three years afterwards, in 1859, the magenta was introduced. In 1861 we had the aniline blue; in 1863 the Hofmann violet; and in 1865 the Britannia violet. Thus we see that all these colours have not only been discovered, but introduced commercially, in a period of less than ten years.

We have now reviewed the principal coal-tar colours, but there still remain some important ones for our consideration next lecture; and although some of these are not at present largely used, yet it is to them, perhaps, that we may look for the future development of this branch of industry.

THE PRESERVATION OF MEAT.

The following letter has been addressed to the editor of the *Daily News* :—

Sir,—I am directed by the Lords of the Committee of Privy Council for Trade to transmit to you the enclosed copy of a decree, issued by the Argentine Government, which has been received through her Majesty's Minister at Buenos Ayres, offering a prize of £1,600 to the inventor or improver of the best method of preserving meat. I am, &c.,

Robert G. W. Herbert.

Office of Committee of Privy Council for Trade,
Dec. 31, 1868.

"*Decree.—Buenos Ayres, Nov.* 2, 1868.

"In pursuance of the authority given to the executive power, by the law of the National Congress of the 7th September, to apply the sum of 8,000 hard dollars to a prize, to be given to the inventor or introducer of the system of preserving fresh meat, best adapted, in the judgment of the executive power, to its working on a great scale, the President of the Republic decrees that a term of six months is fixed, reckoned from this date, in order that those who shall consider themselves in a position to try for this prize may present their proposals, within that time, to the Ministry, to be examined in the way the Government may think fit.

"(Signed)
"Sarmiento Dalmatius Velez Sarsfield."

THE MEYRICK COLLECTION OF ARMS AND ARMOUR.

(*Continued from page* 105.)

The two suits of armour mentioned at the conclusion of the notice printed last week in the *Journal* may be regarded as the culminating point of the collection. From the first bay to this point, the arms and armour, bay by bay, increase in number, in variety, in artistic quality, and in improvements. Commencing, however, with the reign of James I., it will be observed that the number of arms and of specimens of armour sensibly decreases, although the ingenuity displayed in the make of the arms, particularly the fire-arms, &c., naturally progresses. With the reign of William III. the collection of European arms, &c., terminates. The series, however, of suits of armour ends at the suit of pike-man's armour; and the last mounted figure of the historical collection is a dragoon of Charles the Second's time.

To return to the notice of individual specimens. The bay devoted to James I. and Charles I. is principally occupied by a mounted figure, in a richly engraved and gilt suit of armour, in which the "tappul," or point, has entirely disappeared, and the "cuirass," similar to that in use at the present time with the Household Troops, has taken the place of the pointed breast-plate. The design enriching this suit is chiefly composed of scrolls, in the midst of which are emblazoned the arms of the Italian families Manfredi and Monaco. The work is dated 1620, and the suit was one for state occasions. Upon a wooden support to the left-hand side, at the back of the mounted figure, is the last piece of armour in the collection having a "tappul," or point, towards the centre of the breast-plate at the waist. The thigh-guards—very similar to the "tassets" of earlier periods, are, as well as the other portions of the suit, enriched with gilt work. This specimen is unique, and of great value. Below it is a shield through which is fixed a rapier of the finest steel, and of such pliability that the point can be brought round to the hilt, without damaging the rapier. In the shield, itself are two curious apertures or slits; one of these, the upper one, allowed the soldier using the shield to look through, while at the same time he wounded his adversary with the point of his sword through the lower slit. On the wall, the collection of fire-arms presents a very complete appearance. Amongst the pistols should be noticed a great rarity, in a double-barrelled wheel-lock pistol, as well as an axe with a pistol attached. The peculiarity of this latter object is the distance intervening between the trigger and the lock. The hilt of a sword, in delicate chiselled work, is worth careful examining. At the top of this board of arms is a folding bow, jointed in the centre, and at the side is an inlaid dag. The inlay work pourtrays, with much minuteness and accuracy, a number of figures in costumes of the period, thus affording much that is of interest to the antiquary. Next to these arms are some miscellaneous bits of engraved and gilt armour, of which the two "cuisses" are the most conspicuous, both for interest and workmanship. The gauntlet, an historically interesting piece, is said to have belonged to Henry, Prince of Wales, his cypher, H.P., being engraved at the wrist. It is not improbable that this gauntlet is one which belongs to the unique suit of armour—the property of Her Majesty the Queen—at Windsor Castle. An object which will necessarily arouse the attention of visitors who give more than a hasty and general inspection to the collection, is a gun with a set of eight revolving chambers, nearly identical to a Colt's revolver, placed next to the above-mentioned armour. It is certainly a more ingeniously contrived weapon than the hunting prodd near it, the stock of which is a barrel, and the prodd thus becomes available to be employed both as a wheel-lock and a prodd. Below a set of claymores and target, which, if the chronological arrangement of the whole collection had not been carried out under Mr. Planche's direction, one might have supposed more fitly belonged to a later period than Charles I., perhaps James II., is a very interesting steel mask, formerly used by executioners. It is of black beaten or repoussé steel, and, although not obtrusively hideous, is still somewhat repulsive, particularly when looked at in conjunction with the instruments of capital punishment and torture placed near the window, opposite Charles I. bay. Before noticing these, however, mention must be made of the cuirass placed over a leathern jacket, the arms and skirt of which are delicately embroidered with very thin silver lace, of the helmets which abound plentifully in this bay, and, lastly, of the pikes, called 18 feet pikes. The instruments of torture are represented by two executioners' swords, with engravings on the blades of various modes of punishment in process of infliction upon criminals; between the swords are smaller but, to English minds, more obnoxious vehicles for carrying out the criminal punishments of James and Charles the First's reigns—such as thumbscrews and an iron whip. The tiger's claw, a secret weapon, consisting of three iron claws fixed to two rings through which the operator's fingers passed, and the hand thus concealing the claws, is an Oriental implement. Placed at the termination of the sixth bay is a suit of German "splints," belonging to a German "ritter."

The Commonwealth period occupies the staircase leading to the upper galleries of naval architecture, &c. The objects are few in number, and, excepting a good lobster-tailed helmet, the triple-barred head-protectors, and a wall-musket, a revolver with the chambers revolving at right angles to the lock, and a gilt wooden powder flask, there is not much to call for especial notice. The pikes and halbards about this period were of an ornamental description. The stand of pikes, &c., at the foot of the staircase terminates with a fine black suit of armour belonging to a pikeman. It will be here observed that the tappul has entirely been abolished. This suit is the last complete one in the collection, and after it come trophies of guns, &c. At the side of the first of these is a most remarkable "partisan," the shape of which corresponds curiously with the unornamented "partisans" of Edward the Third's time. The ornamentation of this weapon, gorgeous, repoussé, and pierced-work gilt, is of the best kind. Two richly-carved Austrian guns form appropriate companions to the "partisan." The double-barrelled gun is a specimen of inventive genius, the second barrel being on a hinge below the principal one. At the back of the mounted dragoon in a triple-barred helmet and thick buff leather coat, the skirts covering the thighs down to the knees, is a board on which is a very handsome "gorget," a specimen of the latest species of armour worn, excepting the cuirass, of which, both in the reigns of James II. and William III., there are some dark blue steel ones.

It was in the reign of Charles II. that the bayonet appears to have been first used. In fact many of the arms which, a few years previous would have been battle-axes, have an inclination to a bayonet form of weapon. This is especially shown in the two Dutch battle-axes in James the Second's bay, Of the bayonet proper, the first example is exhibited on the board of arms, &c., in Charles the Second's bay. In the place of the present contrivance, spring catch, &c., for fixing it to the barrel of the gun, is a simple tapering wooden end, and this was forced into the muzzle of the musket, thus rendering the musket temporarily useless for shooting purposes. Then, in the time of James II., there are variations in the form of the bayonet; there is a "short flaming bayonet" and a short bayonet, engraved with an inscription. Those interested in military arms, may, perhaps, remember the short bayonet exhibited by Mr. Scott Tucker, in the Paris Exhibition, 1867. It is a curious coincidence that the various changes and phases through which the bayonet passed, during the first few years of its invention, should be nearly similar to the changes and improvements which, at the present time, are constantly going on. Mr. Scott Tucker's bayonet, already referred to, is nearly half the length of the ordinary triangular one, and is almost the same length as the bayonet of James II. It is not improbable that the same idea may have prompted the respective inventors to produce, in the leading principles, almost identical arms. The last remarkable rapier in the collection is the one exhibited on a board in the time of James II. The blade is engraved with events from the life of Joseph. A pair of high-heeled Dutch boots, and some hunting implements, bring the collection of European arms and armour to a conclusion.

In the adjoining room is exhibited many pieces of Oriental armour and weapons, all chiefly of comparatively recent date. There is a complete suit of Japanese mail armour, ornamented with embossed brass plaques, which is curious. Disposed amongst the numerous cases, and on the walls, are many swords, shields of rhinoceros hide, damascened and perforated; Persian and Turkish helmets, portions of Indian suits of armour, wonderfully inlaid with mother-o'-pearl and ivory; examples of firelocks, cuttars or kreeses, and a fine double-handed sword of state. Beyond these is a series of weapons used by the natives of the South Sea Islands; and with these latter the "Arms and Armour Collection" is brought to a termination.

Besides this splendid and unrivalled collection, the more especial objects of which this notice has, it is hoped, been the means of bringing before the members of the Society of Arts, there is a most excellent exhibition of ivories, and a few other objects of great value and interest. In the collection of ivories may be found two small miniatures in ivory boxes, the lids of which are delicately carved; miniatures respectively of Henry VIII. and Anne of Cleves, painted by Holbein. The miniature of Anne of Cleves is the original one which was sent to Henry VIII. before his engagement to her. In a case beyond are shown some Limoges enamels, other "objets de vertu," and some good bronze works; in particular a fine knocker, formerly belonging to the door of the principal entrance at Goderich Court. The work, attributed to Giovanni di Bologna, represents the slaughter of the Philistines by Samson.

It is difficult not to enlarge upon the merits of the many objects in this case, such as a beautiful piece of chiselled work for the hilt of a sword, a carved box, which belonged to Mary Queen of Scots, and a jester's wooden belt; but the objects are very numerous, and the present article being one on arms and armour, it is inexpedient to attempt to deal with the latter section of the entire Meyrick collection. The mention already made perhaps will suffice to draw attention to the fact that, in addition to the incomparable display of armoury, the collector, Sir Samuel Meyrick, proved his appreciation of other art works.

That the entire collection, as it stands, is most fitting to become the property of the nation none can gainsay; and it is most earnestly to be hoped that, before the termination of its loan to the South Kensington Museum, the Government, recognising the importance of preserving it intact, will unhesitatingly come to a decision, and secure it for the historical and artistic enlightenment of the people of Great Britain.

Amalgamated with the armour collection from the Tower of London, the two combined collections, placed in a suitably-planned and well-adapted exhibiting gallery to be erected in some more accessible locality of the metropolis than Tower-hill, would form a centre of attraction for all classes and nationalities, and would, undoubtedly, be a collection of its kind unsurpassed, worthy to take the highest rank amongst the foremost ones in Europe.

Fine Arts.

◆

Museum of Casts, Paris.—A considerable collection of groups, statues, bas-reliefs, &c., moulded from the best examples of sculpture in the museums of Rome, Florence, Naples, and London is now being arranged at the Imperial School of the Fine Arts, in Paris. A fine inner court, known as the Cour de Marbre, from its pavement, has had a glass roof thrown over, to form a museum. Visitors to Paris will remember this court as leading to the semi-circular amphitheatre, in the walls of which is Delaroche's famous painting of the celebrated artists of all ages and countries, supposed to be assembled to award prizes to modern competitors.

Paris Academy of Arts.—The commission appointed to select names of artists for the election of a foreign member of the Academy, in the room of the late composer, Rossini, presented the three following:—Sir Edwin Landseer, R.A.; M. Dracke, Prussian sculptor; M. Dupré, also sculptor, of Florence. On the reception of the list, the Academy, according to custom, added other names—those of M. L. Gallait, Belgian painter; Signor Pietra Rosa, architect and archæologist, of Rome; and M. Geefs, the well-known Belgian sculptor.

French Provincial Fine Art Exhibitions.—The results of the Havre Exhibition of Pictures, in connection with the Maritime Exhibition, are not very brilliant as regards sales. The total amount is only equal to £1,624; of this the town itself contributed £300, the Society of the Friends of Art £404, and private purchasers £920. We have a very different account from the town of Ghent, where the purchases at the exhibition have reached the important amount of £5,600. The cases are not, however, quite analogous: the exhibition at Ghent is purely an art exhibition, and a well established one, while the Havre show was merely annexed to the maritime exhibition, and, moreover, the building was not commenced till after the opening of the maritime galleries; still, with all allowance made, the difference is strikingly against the rich and flourishing port of Havre, especially considering the collection of pictures was a very good one.

Manufactures.

◆

The Tobacco Manufacture in Italy.—The tobacco plant is cultivated, by exception made to the royal monopoly on tobacco, in the provinces of Ancona, Benevento, Terra di Lavoro, Principato Citeriore, Terra d'Otranto, Umbria, Vicenza, and Sardinia. In 1867, 3,806 hectares of tobacco were cultivated, containing 46,129,565 plants. The following was the production of tobacco in Italy from 1864 to 1867 :—

	Hectares.	No. of plants.	PRODUCTION.	
			Quantities.	Value.
			Quintals.	frs.
1864.........	1,222	16,246,000	13,796	784,000
1865.........	1,733	22,682,000	16,470	909,000
1866.........	2,361	32,683,000	21,618	1,197,000
1867.........	3,806	46,129,565	30,054	1,736,000

The average production, in 1867, per hectare was 789 kils. of tobacco, and 65 kils. per 1,000. The greater part of the tobacco used in Italy is imported from abroad, and, in 1866, 93,856 quintals were imported from America. The number of manufacturers of tobacco was 14, 9 of which were first-class and 5 of second-class. The first-class manufacturers are at Naples, Turin, Milan, Venice, Florence, Bologna, Lucca, Chiaravalle, Modena; the second-class are those of Parma, Sestri Ponente, Cagliari, Massa Carrara, and Lecce. The motive power of these manufactories, comprising 10 steam-engines, 31 water-wheels, and 7 turbines, amounts to upwards of 250 nominal horse power. The number of persons employed in these works, in 1867, was 15,055, of which 214 were employed in the administration, 470 superintendents, and 14,371 workmen. The wages amounted to 5,790,312 francs. The average wages earned by the cigar makers varies from 2·30 to 2·50 per day for men, and the women engaged in this branch earn from 1·45 to 1·90 per day. The wages for those employed in preparing snuff and cut tobacco vary from 2·20 to 4 francs per day for the men, and from 1·35 to 2·05 francs per day. The production of tobacco of these manufactories in 1867 was as follows :—

	Quintals.
Cigars	51,592
Cut tobacco	65,409
Snuff..........................	33,976
Total....	150,977

The greatest quantity of tobacco was manufactured at Naples, 27,714 quintals; the next in importance was at Turin, 25,275 quintals; Milan, 21,197 quintals. The following shows the quantity and value of the tobacco manufactured in Italy, not including the Venetian provinces, from 1863 to 1867 :—

	Quantities. Quintals.	Value. Francs.
1863	112,463 ..	69,507,000
1864	122,684 ..	75,421,000
1865	110,655 ..	76,680,000
1866	120,739 ..	84,035,000
1867	119,565 ..	79,977,000

For 1867 the quantity of tobacco sold in the Venetian provinces was 16,865 quintals, of which there were 6,458 quintals of snuff, 4,800 quintals of cut tobacco, and 5,573 cigars. The produce of this sale amounted to 12,471 francs. The various quantities of tobacco sold in 1867 were as follows:—

	Quantity. Quintals.	Amount received. Francs.
Snuff	26,305 ..	13,802,000
Tobacco in cord..	12 ..	6,000
Ditto cut........	60,914 ..	29,085,000
Cigars	32,334 ..	37,084,000
Total	119,515	79,977,000

The imports of tobacco, in 1866, were 5,994 quintals, amounting in value to 2,400,000 francs; and 31 quintals of Havana cigars, of the value of 170,000 francs, making a total value of imports of 2,570,000 francs.

ENGLISH MACHINERY IN SIAM.—English machinery is being largely employed by the natives of Siam. The Siamese dockyards are busy building and repairing steamers; iron bridges have been erected over some of the creeks; gas-works constructed in the palaces of the King and Prime Minister; two steam dredges put together and set to work; and another steam rice mill added to the four large mills already existing. A large sugar mill and distillery; a saw mill; British ship-yard and dry-dock, have been in operation since the beginning of 1867; and as the supplies for all these come almost entirely from England, there must be a very considerable export of British machinery going on to the East.

Commerce.

COMMERCE OF ITALY.—The following table represents the exports and imports of Italy in 1866, as compared with those of 1865* :—

	Commercial Value of Imports.		Commercial Value of Exports.	
	1865.	1866.	1865.	1866.
Wines, spirits, oils, etc.	38,624,754	37,884,112	115,111,524	131,773,236
Colonial produce, sugar, etc...........	128,349,528	124,125,797	38,283,432	43,284,393
Fruit, seeds, herbs, and plants............	5,667,924	3,379,771	67,465,154	58,177,898
Tallow and other fatty substances ...	15,991,361	15,570,738	11,597,959	16,488,014
Fish	13,232,563	13,934,681	849,482	1,277,449
Cattle	12,532,771	18,420,528	8,616,100	17,161,720
Skins and hides	29,587,237	37,391,465	4,505,036	9,711,551
Hemp and flax (raw or manufactured...	21,696,821	20,720,849	26,325,268	33,292,828
Cotton (ditto)	106,572,843	127,445,615	9,227,184	13,821,408
Wool, hair (ditto) ..	84,313,009	85,210,004	3,160,438	13,480,918
Silk (ditto)	168,477,975	137,025,540	148,900,414	183,902,880
Corn, cereals, flour, and pastes......... ...	152,192,432	98,135,198	43,785,131	37,346,341
Timber & woodwork	20,362,923	40,897,284	8,945,685	8,449,777
Paper and books	5,508,239	4,711,242	6,881,084	4,963,508
Hardware & cutlery of all sorts	44,113,100	36,105,445	16,464,317	25,273,676
Metals & metal work	60,480,174	54,352,908	3,613,798	12,889,753
Gold, silver, precious stones, & jewellery	3,939,136	5,716,165	2,965,394	6,980,150
Stone, marble, etc ..	22,366,757	26,068,317	40,762,081	46,865,326
Porcelain, earthenware, glass, etc....	15,505,612	9,428,743	709,382	2,005,531
Tobacco	15,658,513	20,773,208	156,733	802,789
Total frs.......	965,173,672	917,297,605	558,285,576	627,942,146
Total £	38,606,947	36,691,904	22,331,423	25,117,966

PORT OF BRINDISI.—The dredging in the port of Brindisi is being pushed forward in a most satisfactory manner. The amount of stuff raised by the dredging machines during the month of October was upwards of 40,000 centimetres.

JAPANESE TEA has hardly fulfilled the anticipations formed of it in the earlier years, and the trade in it has taken little development. The demand, such as it is, is almost entirely for American consumption. In 1867, 67,400 cwts. was shipped, principally to America. In 1865, the export was 74,000 cwts. Occasionally small shipments are made to England, but the market there is uncertain, and the quality is evidently unsuited to the demands here.

SIAM COTTON.—In 1867, 15,710 cwt. of cotton, of the value of £56,874, was exported from Bangkok, about half of which was in the seed.

RE-ARRANGEMENT OF APOTHECARIES' WEIGHTS IN GERMANY.—North Germany has adopted the French *gramme* as the basis of medical weights, and this obliges certain German States to alter their pharmacopœias. This is especially the case as regards the Grand Duchy of Mecklenburg-Schwerin; but it being evidently inconvenient that each State should make changes without concert with its neighbours, the representative of the Grand Duchy has proposed to the Federal Council to convoke a commission of medical men and apothecaries to establish a pharmacopœia common to all the States of the German Northern Confederation.

---

* See vol. xvi. of *Journal*, page 233, for those of previous years.

Colonies.

Wine Vats in Victoria.—A new branch of business has been opened to the coopers of the colony in the manufacture of vats for use in the cellars of the wine makers. Some very large elliptical vats, with concave sides for this purpose, have lately been turned out.

Mining in Victoria.—Mining operations are in a satisfactory condition, continued progress in the mineral resources of the country being reported from all quarters. The gold mining industry, indeed, is rapidly resuming a very important place in the pursuits of the colony, and the principal gold-fields are now looked upon by the merchants, shopkeepers, and the labouring classes as affording almost unlimited operations. The discovery of the Mary River gold-fields may be said to be the beginning of a new era in the mining history of this colony. Good news from many other diggings is frequently received, but in consequence of the more brilliant attractions on the fields just mentioned, the news in question does not receive that attention which it deserves. While many of the digging population are amassing fortunes, the vast majority may be said to be doing well and earning good wages.

Obituary.

Abraham Cooper, honorary retired R.A., died on Thursday, the 24th December, at Greenwich, in the 82nd year of his age. He was born in September, 1787, in Red Lion-street, Holborn, of parents in a humble condition of life. He was elected an Associate of the Academy in 1817, and attained the full honours of that society in 1820, the same year which witnessed the election of Sir Thomas Lawrence to the presidential chair. In early life he passed much of his time among horses, and to this circumstance must be ascribed the direction in which his artistic talents developed themselves in youth. His first picture, properly so called, was the portrait of a favourite old horse belonging to the late Sir Henry Meux, Bart. By the advice and encouragement of Sir Henry, he was led to resolve to devote himself to art in earnest, and in him he found his earliest and most liberal patron. The only studio frequented by him was the stable or the grass-field, and the only books he consulted were some old numbers of the *Sporting Magazine*, illustrated with portraits of horses drawn by Marshall, a well-known animal painter of that time. His first exhibited picture, "Tam o'Shanter," sent to the British Institution in 1814, was bought by the then Duke of Marlborough. Mr. Cooper has been a constant exhibitor both at the Royal Academy and at the British Institution. He was the chief "battle painter" of the English school, and among his principal pictures may be mentioned "Blucher at the Battle of Ligny," "Cromwell at Marston Moor," "Lord Arundel Capturing a Turkish Standard," "Lord Arthur Capel defending Colchester during the Civil War," "The Battle of Shrewsbury," "Sir William Russell at the Battle of Zutphen," "The death of Harold," "Richard I. and Saladin at Ascalon," "The Battle of Assaye," and "The Battle of Waterloo." Several of these pictures have been engraved. The most widely known of all, perhaps, is his "Hawking in the Olden Time," which has been engraved, and, side by side with his "Greeks and Arab Horses," graces the collection of the Marquis of Westminster. Mr. Cooper also exhibited at various times "Arab Scheiks examining Captives," "Baggage Waggons attacked," "Highland Courtship," "Harvest in the Highlands," "The Dead Trooper," "The Return from Deer-stalking," "The Battle of Lewes." So lately as the Academy of 1867, he exhibited three paintings—"Arabs," "The Painter and his Models," and "Dressing a Fly, a scene in Glen Urquhart, with Urquhart Castle in the distance;" and in 1868, he exhibited one picture, "A Scene from Don Quixote."

Publications Issued.

Exposition Maritime Internationale du Havre, 1868. Rapports du Jury International et Catalogue Official des Exposants Récompensés. London: (*J. M. Johnson and Sons*, Castle-street, Holborn.)—This is a handsome volume of 650 pages, containing all the official details of the Havre Exhibition. An extract from the speech of the Minister of Agriculture and Commerce, on the occasion of declaring the Jury Awards, given in the introduction, well sets forth the purposes for which this Exhibition was originated:—"The principal object of the promoters of the Exhibition was the development of the industries identified with ship-building and maritime commerce. The vicinity of the docks of Havre afforded an opportunity for establishing a competitive examination of vessels afloat, that had been wanting in former Exhibitions. The International Jury were thus able to examine, not merely by models on a small scale, but upon the ships themselves, the improvements which had been made of late years in the build and fitting of sailing and steam vessels. It was a happy idea to give the place of honour to the ship, that *chef-d'œuvre* of science and of industry, that marvellous machine, so rapid in its speed, so docile under the hand that guides it, so powerful and yet so fragile at the same time, that it seems a being created with living organs and an intelligent force, to aid man to traverse the sea, and to combat the elements. A Maritime Exhibition held at the port of Havre naturally drew together a concourse of foreign nations. Great Britain, Belgium, Holland, Germany, and the United States, among others, felt themselves called upon to be represented. A cordial hospitality was offered to all who responded to the appeal thus made, and they were received, not as rivals, dreaded or wished absent, but as friends associated in the same labour, exposed to the same dangers, devoted to the same work—the progress of general commerce. England, above all, occupied an important position in the Exhibition. She contributed her models of ships, her appliances for fisheries, and the improved products of her industry; she now looks forward with you towards renewed progress as the result of these useful comparisons It is unnecessary to dilate upon all the advantages that have resulted from this close connection, which, during the last twenty years, has become, between France and England, more and more intimate. To allude only to its commercial results—the aggregate imports and exports annually exchanged between the two nations 20 years ago only reached in value £8,000,000; since the Empire, the increase has been so rapid that, in 1866, the amount exceeded £72,000,000. In former times the sea was made the battle-field, on which each struggled to dominate. At one time nations disputed with arms for the monopoly of distant colonies; at another, for the privileged possession of a commerce in itself restricted, and for ever menaced. Now, the sea is merely a highway; colonial ports are open to all flags and to all kinds of merchandise. The ports see removed those fortifications which formerly so jealously guarded them; they are transformed, and then enlarged into formidable cities, where the products of all parts of the world are brought together, and exchanged. In fact, maritime commerce has become one of the most powerful means of connecting nations by identifying their interests." The volume opens with the official report of M. P. Nicolle, the Director of the Exhibition. This is followed by lists of the *personnel* or staff; the various committees, foreign delegates, and jurors; and it may here be mentioned that a novel feature in this Exhibition was the election of jurors by the exhibitors themselves, which seems to have worked well, and given satisfaction. The jury reports and the lists of awards made, with the motives which induced them, are given, and the whole is published in two languages, French and English. Notices of the aquarium, of the horticultural and poultry shows, the congress held on maritime affairs, health at sea, and the various musical and other *fêtes*, wind up the book, which is alike creditable, in its arrangements and completion, to the direction and the publishers.

The Architect: a Journal of Arts, Engineering, and Building.—(*Gilbert Wood*). This is a new technical journal in connection with the subjects its title denotes. The first number appeared on Saturday, the 2nd instant, and it will be continued weekly each succeeding Saturday.

Notes.

◆

Excavations at Rome.—The excavations which are being carried on in Rome are fruitful of interesting results. The last announcement is that the Emporium has been found intact, being merely enclosed by barbarous constructions, which are being cleared away. Another report is that a large number of blocks of rare marbles have been found, including seven blocks of violet paonazetto, which is not now to be obtained at any cost; the remainder consists of Porta Somta, Africano, Milesio and Parian, the blocks being as remarkable for their size as for their extraordinary beauty.

Universal Exhibition at Vienna.—The Austrian Government has decided on organising a grand international exhibition at Vienna. The site to be devoted to the purpose is a large park, which will afford accommodation for a building with, surrounding grounds on a very extensive scale. Full particulars will be available shortly.

New Line of Steamers between Brindisi and Alexandria.—Messrs. Florio and Company, of Palermo, the proprietors of the Italian mail steamers between Naples and the principal Italian ports, are about to establish a line of steamers between Brindisi and Alexandria. The first voyage will probably be made shortly.

Annual Show of Cattle in Paris.—The first cattle show at the new general market of La Villette is announced to take place in March next. The animals are to be received and weighed on the 20th and 21st, when the classification and cataloguing will be performed; on the 22nd the jury will settle the awards, and in the afternoon visitors will be admitted by payment of five francs; on the 23rd the admission will be one franc; and on the following day the show will be thrown open gratuitously to the public. The prizes will be distributed by the Minister of Agriculture and Commerce.

The Mont Cenis Tunnel.—During the first fortnight of the past month (December), the progress made at the Mont Cenis tunnel was 41·15 metres, of which 20·80 metres were driven at the Italian side, at Bardonnèche, and 20·35 on the French, at Modane. The position of these works up to the 15th December was as follows:—

Length driven at Bardonnèche	5,340·20
Length driven at Modane..........	3,776·95
Total length driven	9,117·15
Length remaining to be driven	3,102·85
Total length of tunnel	12,220·00

The Suez Canal.—During the month ending 15th November, the excavations for the Suez Canal amounted to 2,102,000 cubic metres. This is the fourth month in which the excavation has exceeded two millions of cubic metres. Six steam dredging machines on the canal, between Port Saïd and Rasa El-Ech, excavated 313,628 cubic metres, or, on the average, 52,271 cubic metres each. The quantity, however, excavated by one of these dredgers amounted to 88,889 cubic metres, or near 3,000 cubic metres per day. The position of these works up to the 15th November was as follows:—

	Cubic metres.
Amount excavated up to 15th October, 1868	51,347,718
Ditto from 15th October to 15th November	2,102,000
Total amount excavated up to 15th November	53,449,718
Remaining to be excavated	20,662,412
Total excavation in line of canal	74,112,130

International Stamps for Payment of small Sums.—It is said that the French Government is about to propose to all the states that have adopted the French monetary system the use of stamps for the payment of small sums. Some mode of liquidating amounts too small for a banker's draft has long been wanted, though this is supplied as regards several countries (Prussia, Italy, and Belgium) by international post-office orders. It is not, therefore, these countries that most require such an arrangement as that proposed, but England, Austria, Russia, and the United States, which have neither monetary nor money-order arrangements with France. At present the only way of paying a small amount in one of these states is to keep a supply of postage stamps of the country, which is not always convenient, or even easy of accomplishment.

The Communal Schools at Milan.—The total number of pupils at the communal schools at Milan is 12,550, being a considerable increase on the number of last year. This number is divided as follows:—

Elementary schools for boys	5,418
" " " girls	3,755
Evening schools	2,192
Fête day schools	1,185
Total......	12,550

Correspondence.

◆

Artificial Refrigeration.—Sir,—Having read the replies from Dr. Paul and Mr. King, I can only repeat that an ice-making machine was applied to "direct refrigeration" in Messrs. Flower's brewery two years before Mr. King so applied it in Messrs. Truman's. Dr. Paul does not seem to be aware that although Kirk's machine at Stratford can be used for making ice, it has also been applied to the direct refrigeration of beers and worts. The saving in waste, which Dr. Paul dwells on in his letter, and which he considers Messrs. Flower are not acquainted with, was ascertained by them two years ago, and since that time the machine, although occasionally used for ice making, is almost constantly employed in refrigeration, at a temperature of from 35° to 40°. For this purpose the brine, instead of passing through the cells of the ice-box, is merely turned through the ordinary brewers' refrigerator. This is certainly the simplest and most direct refrigeration possible, and the saving in cost over ice-making is considerable, as a pressure of 60 or 70 lbs. is sufficient, instead of 100 lbs. which is required to bring the temperature of the machine low enough to make ice. I have not taken out a patent with a view to profit, but simply to record the first practical and successful application of artificial refrigeration to brewing. I am quite aware that vast improvements may be expected, and to that end I shall ever be ready to give to others, as I have already done to Messrs. Siebe and King, any information or assistance in my power. I only write to you lest my silence should be construed into an acquiescence with an inaccurate statement in Dr. Paul's paper. Having done so, I shall not trouble you further. I am, &c., Charles E. Flower.

Stratford on-Avon, January 2nd, 1869.

MEETINGS FOR THE ENSUING WEEK.

Mon......R. Geographical, 8½. Mr. Douglas W. Freshfield, "Journey in the Caucasus, and Ascent of Kasbek and Elbruz."
Medical, 8.
London Inst., 6.
Tues ...Medical and Chirurgical, 8½.
Civil Engineers, 8. Discussion upon Mr. S. P. Bidder's (jun.) paper, "On Mechanical Appliances for Getting Coal."
Photographic, 8.
Ethnological, 8. Mr. H. H. Howorth, "On the Westerly Drifting of the Nomades, from the Fifth to the Nineteenth Century."
Royal Inst., 3. Mr. Westmacott, "On Fine Art."
Wed ...Geological, 8. 1. Prof. Huxley, "On the *Hyperodapedon* of Elgin, Devon, and Central India." 2. Mr. W. Whitaker, "On the Locality of a New Specimen of *Hyperodapedon* on the South Coast of Devon." 3. Mr. W. H. Baily, "Notes on Graptolites and allied Fossils." Communicated by the President. 4. Mr. W. H. Baily, "On Plant-remains found associated with the Basalt in the North of Ireland." Communicated by the President.
Graphic, 8.
Microscopical, 8. Dr. H. C. Bastian, "On Mounting and Tinting Animal Tissues."
R. Literary Fund, 3.
Archæological Assoc., 8.
Thur ...Royal, 8½.
Antiquaries, 8½.
Zoological, 8½.
Royal Society Club, 6.
Mathematical, 8.
London Inst., 6.
Royal Inst., 3. Mr. Rupert Jones, "Protozoa."
Society of Fine Arts, 8. Annual General Meeting.
Fri ......Philological, 8½.
R. United Service Inst., 3. Capt. J. R. C. Colomb, "The Distribution of our War Forces." Part I.
Royal Inst., 8. Prof. Tyndall, "Chemical Rays and Molecules."
Sat ......Royal Inst., 3. Prof. Odling, "Hydrogen and its Analogues."

Patents.

◆

From Commissioners of Patents' Journal, January 1.

Grants of Provisional Protection.

Alum, &c., manufacturing—3870—P. Spence.
Anchors, carrying in board after being weighed—3856—E. S. Griffiths.
Bandages—3890—T. B. Hubbell.
Bobbins—3813—M. Brown-Westhead and R. Smith.
Carriages—3862—G. D. Robinson.
Casks, cans, &c., metallic—2611—D. Evans.
Cartridge pouches—3807—R. S. Garden.
Coal, &c., getting—3884—J. S. Walker.
Colouring matters—3527—A. Leykauf.
Copperas, manufacturing—2959—P. Spence.
Corsets—3809—J. W. Chilcot.
Cotton, &c., cleaning, &c.—3803—C. Mather.
Diving dresses, &c.—3175—A. Denayrouze.
Electricity, machines for exciting frictional—3878—W. F. Stanley.
Engine counters—3799—J. Hay.
Fabrics, composition for the surfaces of—3833—G. Ritchie.
Fire-arms, breech-loading—3859—S. Remington.
Flax, &c., machinery for breaking, &c.—3787—G. A. C. Bremme.
Gas—3843—G. H. Benson and W. G. Valentin.
Hats—3805—H. Williamson.
Heating apparatus—3865—J. Petrie, jun., and W. T. Cheetham.
Hydro-pneumatic pumps—3894—P. G. Jarre.
Jute, &c., treating—3864—E. Pavy and J. Clark.
Ladies' skirts—3872—W. S. Thomson.
Leather, currying and dressing—3900—H. T. Vanner and E. Prest.
Lock spindles, &c.—3791—W. Meakin.
Locomotion, mechanism applicable to—3888—W. Pidding.
Lubricators—3783—G. Preston and J. Prestige.
Lubricators—3847—R. Hallimond.
Mangles—3821—W. N. Nicholson.
Materials, machinery for turning—3781—S. Cowperthwaite.
Millstones, dressing—3789—J. Hine.
Nuts, forging—3853—J. W. Brierley.
Omnibuses, &c.—3663—P. Ellis.
Omnibuses, &c., tell-tales for—3827—R. Wappenstein and R. Ray.
Parasols, &c.—3898—G. Ritchie.
Photographs, &c.—3849—J. Pouncy.
Pins, &c., tinning—3858—J. Edridge and J. Merrett.
Ploughs—3882—W. Lewis.
Printing purposes, metallic cylinders for—3801—A. Watt.
Railway rolling stock, &c.—3825—T. C. Fidler.
Railway signals—3841—W. Manners.
Railway switches, &c., working—3793—J. J. Stevens.
Railways, preventing collisions on—3800—T. Lynch.
Rocks, &c., cutting and working—3876—W. R. Lake.
Sewers, &c., ventilation of—3868—J. Brierley.
Sewing machines—3854—W. F. Thomas.
Ships, assisting the flotation of—3851—E. T. Hughes.
Shutters and blinds—3845—F. H. Knevitt and H. H. Hazard.
Smiths' bellows—3779—T. Smith.
Sounding machines—3880—J. E. Massey.
Steam gauges—3857—T. B. Salter and J. Silvester.
Stone, &c., tools for dressing—3785—J. Hamilton and J. B. Crawford.
Sulphuric acid, manufacturing—3404—L. A. Israel.
Taps or valves—3896—J. Breeden.
Tea and coffee urns, &c.—3852—E. T. Hughes.
Tobacco-cutting machines—3795—J. Allmark and W. Blakey.
Tubes and rods, ornamenting—3817—J. T. Grice.
Umbrellas, &c.—3874—G. H. Asker.
Velocipedes—3886—E. A. Cowper.
Washers—3892—H. W. Hammond.
Watches, &c., apparatus for winding, &c.—3838—F. Robert-Theurer.
Water-closets—3777—H. Law.
Weaving apparatus—3855—J. Hodgson, H. Bottomley & E. Cockroft.
Windows, lighting painted, &c.—3839—A. Perry.

Inventions with Complete Specifications Filed.

Boots and shoes, machines for pegging—3950—W. R. Lake.
Steam valves, &c.—3941—G. T. Bousfield.

Patents Sealed.

2108. L. Francis.
2110. W. Dean and R. Andrew.
2115. D. Hall.
2127. G. Bennett & J. Woodcock.
2132. J. A. Muller.
2133. J. Head.
2137. E. H. Newby.
2139. T. G. Messenger.
2143. P. Jensen.
2146. E. H. Waldenström.
2177. J. Harris and V. Pendred.
2182. T. Worth.
2230. R. Couty and J. Richard.
2247. W. I. Ellis.
2283. A. Homfray.
2370. A. Morrall.
3122. W. Moodie.
3198. H. A. Bonneville.
3489. H. A. Bonneville.

From Commissioners of Patents' Journal, January 5.

Patents Sealed.

2147. J. H. Whitehead.
2150. G. R. Wilson.
2151. T. J. Mayall.
2152. E. Coppée.
2154. J. Lawson and E. G. Fitton.
2155. T. R. Crampton.
2156. B. P. Walker.
2159. T. J. Mayall.
2160. T. J. Mayall.
2164. J. Holt and G. S. Coponet.
2165. J. Prest, W. Mather, and W. Doherty.
2167. A. J. Le Blanc.
2168. E. Coppée.
2171. E. Rouget.
2176. W. Creasy.
2181. W. R. Oswald.
2184. J. H. Johnson.
2193. W. Russell.
2198. J. D. Brunton.
2207. A. Munro and W. B. Adamson.
2218. T. Wood.
2261. D. Webster.
2302. L. Dulac.
2409. H. Moule.
2446. E. Evans.
2683. C. F. Varley.

Patents on which the Stamp Duty of £50 has been paid.

3376. R. Smith.
194. W. K. Hall.
12. P. S. Bruff.
34. F. Wright.
30. T. E. Vickers.
42. E. Walker.
81. W. E. Newton.

Patent on which the Stamp Duty of £100 has been Paid.

55. J. Stenhouse.

Registered Designs.

◆

4986—Dec. 3—Improved ring roller brush—C. Hargrove and G. H. Wain, Birmingham.
4987—Dec. 9—Handkerchief box—H. M. Matier and Co., Belfast.
4988—Dec. 10—A gas-heating and cooking apparatus—L. J. Mills, 21, De Beauvoir-crescent, N.
4989—Dec. 10—Roasting jack—E. B. Bennett and Son, Birmingham.
4990—Dec. 11—The Cestus corset—Chilcate and Co., Landport, Hants.
4991—Dec. 15—The railway key whistle—T. Yates, 37, Coleshill street, Birmingham.
4992—Dec. 28—Handkerchief box—Richardson, Son, and Owden, Belfast.
4993—Jan. 5—A plug washer and grating for sinks—W. S. and J. D. Adams, 41, Marshall-street, Golden-square, W.